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A practical approach to internal inspection of pressure equipment

Internal inspections of pressure equipment involve a full inspection of the equipment. Inspection engineers and inspectors depend heavily on internal inspections to retrieve useful data, which includes information on active degradation mechanisms, corrosion rates, remaining equipment life, failure occurrences and failure expectations, among other critical details.

The results of these internal inspections are also important to operations, process and maintenance teams. Operations and process personnel are curious about the internals of pressure equipment, including information on catalysts and/or other media levels. Maintenance departments are interested to know if the pressure equipment is in good working order, or if repairs and/or replacement equipment are needed.

Internal inspections should be thorough and not miss anything that could lead to an unidentified active damage mechanism. Internal inspections can also identify equipment that should be added and in place during the next inspection opportunity.

Imagine yourself inside a piece of pressure equipment. Without special aids, you could see the equipment's internal surface, internals, weld seams and process debris (if any). Most of the equipment's data will come out of this region. An additional parameter that cannot be easily seen and accurately determined is thickness.

So, what are the basic parameters of an internal inspection? As shown in **FIG. 1,** five essential parameters of pressure equipment are weld seams, internals, debris, surface and thickness (WIDST). These parameters should never be missed when inspecting pressure equipment. Covering these five essential parameters will provide the complete history of the equipment.

WIDST details. "W" stands for weld seams. This parameter is where many degradation mechanisms are linked. Proper inspection, along with an equipment history report, will aid the inspection engineer in deciding on different non-destructive testing (NDT) techniques. These are required to check the health of the welds.

All internals ("I") inside the pressure equipment must be thoroughly inspected, along with their internal welds (if any) and the attachment welds of their support. In addition to the structural integrity of the internals, which are non-pressurized components, they must be inspected by operations or process personnel. In their absence, an inspector can take note of their general condition.

Debris ("D") helps identify the remnants of the equipment's process. Process debris should be collected and analyzed. Information on process debris helps operations and process engineers evaluate process conditions. Inspection personnel must record debris information in their inspection reports, as these details may be used in further studies should a problem occur.

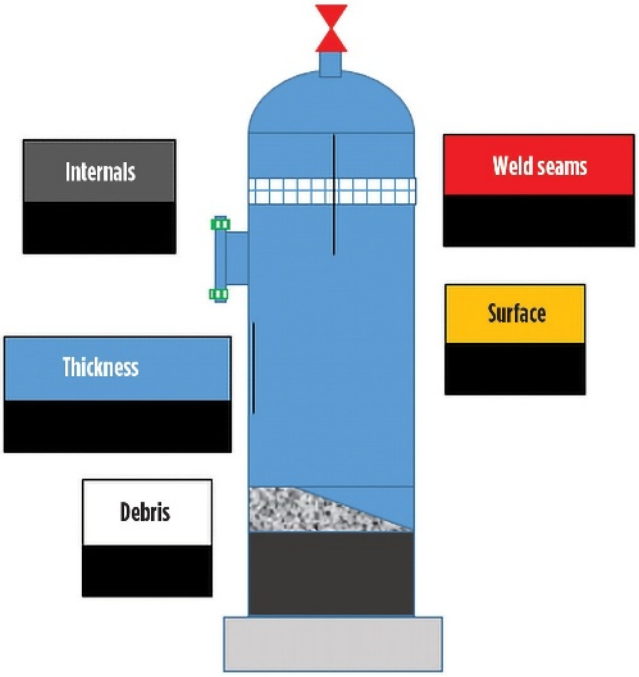

FIG. 1. WIDST approach to internal inspections.

The surface ("S") of the vessel provides significant information for inspection personnel. Starting with the condition of the equipment's surface, followed by the implementation of applicable NDT techniques, this information can provide personnel with crucial details on active damage mechanisms. Even the slightest observations recorded on the equipment's surface should not be missed. Experienced inspection personnel retrieve a lot of information about general conditions and active damage mechanisms by carefully observing the equipment's surface.

"T" represents the equipment's thickness, which is an essential parameter to check. All pressure-retaining parts must be checked for their thickness, and this information is then used for further analysis. When a normal ultrasonic probe is unable to measure thickness (such as with heat exchanger tubes), data collection may require sophisticated NDT techniques.

Although several inspection management software products are available on the market, a basic approach to internal inspection (i.e., WIDST) is needed to ensure that no item is overlooked. HP